

# PATENT SPECIFICATION

(11) 1347808

1347808

- (21) Application No. 24645/72 (22) Filed 25 May 1972  
 (31) Convention Application No. 7119158 (32) Filed 26 May 1971 in  
 (33) France (FR)  
 (44) Complete Specification published 27 Feb. 1974  
 (51) International Classification H04B 1/38 H01Q 7/08  
 (52) Index at acceptance

H4L 11C 23 7  
 H4A 6FX 8



## (54) PORTABLE TRANSMITTER-RECEIVER

(71) CHARBONNAGES DE FRANCE, a Public Institution organised and existing under the laws of France, of 9, avenue Percier, 75—Paris 8eme, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a transmitter-receiver of the type which may transmit and receive alternately and is designed to transmit and receive the same high carrier frequency modulated by the information to be transmitted. The transmitter-receiver is coupled inductively to a signal carrying member along which the signal transmitted passes. Known apparatus of this type is provided with an external aerial serving for transmission and reception. This aerial, which is generally retractable in an appropriate manner, nevertheless constitutes an obstacle to the convenience of use of the apparatus, and in addition it is liable to be damaged by handling, particularly under the severe conditions of use of this apparatus.

The invention relates to means which on the one hand make it possible for the apparatus to be, as far as possible, small, light, and strong, and on the other hand enable the transmission and reception aerial to be incorporated inside the casing of the apparatus.

The invention provides a transmitter-receiver apparatus utilising the same carrier high frequency for transmission and reception, said apparatus being inductively coupled to a ferrite member forming an aerial and common to the transmitter part and to the receiver part of the apparatus, a first winding on the ferrite member making the connection to the transmitter circuit and a second winding on the ferrite member making the connection to the receiver circuit, the inductive coupling means being disposed inside the casing of the apparatus.

In one embodiment, on said ferrite member there are wound firstly a first coupling

loop connected permanently in series to the output of the transmission part, secondly a second coupling loop normally connected in series with a change-over switch between the input circuit of the receiver part and earth, and thirdly a winding independent of the two loops and forming, in conjunction with a set of adjustable capacitors, a circuit tuned to the carrier high frequency.

The components constituting the reception part are preferably disposed in a chain substantially parallel to the ferrite block and separated from the latter by the components of the transmission part. The reception part may be constituted by a receiver of the frequency changer type, of which only the high frequency amplifier and frequency changer stages are provided with inductive components, which are disposed in such a manner that their plane of radiation is orthogonal to the plane of radiation of the common ferrite block.

The second coupling loop may be normally connected in series with the input circuit of the receiver part by means of a contact of a changeover switch, the other contact of which is connected to earth.

The switch may be mechanically coupled to a second switch, the one contact of which feeds the receiver part, while its other contact feeds the transmitter part.

The transmitter part may include a low frequency input amplifier provided with a switchable capacitor converting it into a call frequency oscillator.

An embodiment of the present invention will now be described by way of example and with reference to the accompanying drawings, in which:—

Figure 1 is a schematic diagram of a transmitter-receiver apparatus according to the invention, and

Figure 2 is a basic diagram of an apparatus, according to the invention, of the frequency modulation type.

In these drawings the same references designate the same element. Referring to Figure 1, the transmitter-receiver apparatus

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comprises a transmitter part 1 permanently coupled to a ferrite core aerial 2 by means of a coil 3, and a receiver part 4 of which the input stage is normally coupled to the aerial by a coil 5. A microphone capsule 9 is permanently connected to the output 10 of the receiver part 4 and to the input 11 of the transmitter part 1.

Referring to Figure 2, the transmitter part comprises firstly a low frequency amplifier stage built around transistors T1 and T2 for amplifying the signals supplied by the microphone 9 when switches 6 and 7 are in the position, such that only the transmitter part 1 of the apparatus is operative. The switch 6 has one contact connected in series with the coil 5 and another contact connected to the general earth of the apparatus. The switch 6 constitutes a two way or changeover switch which is coupled to a similar switch 7 of which one contact connects the supply 8 of the apparatus in series with the receiver part 4, while its other contact connects the supply 8 in series with the transmitter part 1. The amplified low frequency arrives at the common point of two variable capacity diodes 13 connected in series with a sliding or shiftable quartz crystal 14 which, together with a transistor T3, constitutes the high frequency oscillator of the transmitter part. The fundamental high frequency of the quartz crystal 14, whether or not modulated in frequency by the amplified low frequency, is amplified in a high frequency amplifier stage formed by transistors T4 and T5 and applied to the coil 3 coupling the transmitter part 1 to the ferrite aerial 2.

The receiver part comprises in succession:

a limiter high frequency amplifier stage formed by the transistor T6 and the two diodes D1 and D2 connected head to tail to the terminals of the tuning circuit of the amplifier stage constituted by the capacitors C1, Cv1, and the inductor L1;

a local oscillator 15 controlled by the quartz crystal 16 and including the transistor T7;

a frequency changer stage 17 which includes the transistor T8 and of which the tuning circuit at the beat frequency or intermediate frequency between the high carrier frequency received and the high frequency supplied by the oscillator 15 is constituted by the capacitors C2, C3, C4 and by the inductor L2, and is provided with a limiter circuit formed by the diodes D3 and D4 connected head to tail at the terminals of this tuning circuit;

three intermediate frequency amplifier stages 18, 19, and 20 formed respectively by the transistors T9, T10, and T11;

an impedance adaptor stage 21 formed by the transistor T12;

a detector stage 22; and

an amplifier stage 23 for the low frequency supplied by the detector stage 22, the output of this stage being permanently connected to the microphone capsule 9 acting as a loudspeaker.

The different components constituting on the one hand the transmitter part 1 and on the other hand the receiver part 4 are disposed in two chains which are parallel to one another and parallel to the ferrite aerial 2, as illustrated in Figure 1, the chain of components constituting the transmitter part being disposed between the aerial 2 and the chain 4 constituting the receiver part of the apparatus, so that coupling by air between the receiver part 4 and the aerial will be reduced as much as possible.

Moreover, the inductive components L1 and L2 are preferably mechanically disposed in such a manner that their plane of radiation is orthogonal to the plane of radiation of the ferrite aerial.

In the form of apparatus illustrated in Figure 2 the connections between the intermediate frequency amplifier stages are made by the capacitors  $C_6$  and  $C_8$ . In addition, the components of these stages have values such that the last amplifier stage 20 normally works as a switching stage and the first two stages 18 and 19 work as amplifiers when the signal received is weak and as a switch when the signal received is strong.

Two decoupling capacitors  $C_7$  and  $C_9$  are disposed as follows: one between earth and the point common to the first amplifier stage 18 and the coupling capacitor  $C_5$ , and the other between earth and the direct connection between the last amplifier stage 20 and the adaptor stage 21; the values of these capacitors  $C_7$  and  $C_9$  are so selected that they represent very low impedance for the frequencies higher than the intermediate frequency. They serve as low pass filters eliminating the residues of the local oscillator frequency and also the harmonics produced at the moments of switching of the input and output amplifier stages of the entire intermediate frequency amplifier circuit (18, 19, 20).

The signals supplied by the impedance adaptor stage 21 are applied to the detector stage 22 constituted by a differentiator circuit  $C_4 \rightarrow R_1$ , a "diode pump"  $D_5 \rightarrow D_6$  and a bleeder resistor  $R_2$ . This stage supplies a polarised signal the amplitude of which varies in rhythm with the variations of the amplified intermediate frequency supplied by the adaptor stage 21, that is to say in rhythm with the modulation of the carrier high frequency received.

Through the action of the switches 6 and 7 the apparatus thus described may alternately receive signals from and transmit signals to another similar apparatus. One position of the switches 6 and 7 sets the transmitter-receiver

apparatus to wait reception position in which only the receiver part is fed and coupled to the aerial 2. Changing over to the other position of the switches entails the disconnection of the receiver part from the aerial 2 and connection to earth of the input of the receiver, the connection of supply to the transmitter part of the apparatus, and the termination of the supply to the receiver part of the apparatus.

The ferrite core aerial 2 is tuned to the carrier high frequency by means of the tuned circuit constituted by the winding 12, which is independent of the coils 3 and 5, and the adjustable arrangement of capacitors C and Ca.

In order to communicate with another transmitter-receiver station, it is necessary that each station should be provided with an oscillator supplying a characteristic call frequency.

In the embodiment illustrated in Figure 2 this call frequency is obtained by using the switch 24 to connect a capacitor C10, which converts the low frequency amplifier  $T_1$ — $T_2$  of the transmitter part into an oscillator.

It will be seen from the above example that the transmitting and receiving parts of the apparatus are both inductively coupled to the ferrite member 2 within the casing of the apparatus.

It is obvious that the present invention, although described in this application as applied to a frequency modulated transmitter-receiver, is likewise applicable to amplitude modulated transmitter-receivers.

#### WHAT WE CLAIM IS:—

1. A transmitter-receiver apparatus utilising the same carrier high frequency for transmission and reception, said apparatus being inductively coupled to a ferrite member forming an aerial and common to the transmitter part and to the receiver part of the apparatus, a first winding on the ferrite member making the connection to the transmitter circuit and a second winding on the ferrite member making the connection to the receiver circuit, the inductive coupling means being disposed inside the casing of the apparatus.

2. A transmitter-receiver apparatus according to Claim 1, in which the first winding

wound on the ferrite member comprises a first coupling loop permanently connected in series with the output circuit of the transmitter part, the second winding comprises a second loop normally connected in series with a switch between the input circuit of the receiver part and earth, and a third winding is wound on the ferrite member independent of the first and second loops and forms, together with an adjustable capacitor arrangement, a circuit tuned to the carrier high frequency.

3. An apparatus according to either of Claims 1 or 2, in which the components constituting the receiver part are disposed within the casing in a chain substantially parallel to the ferrite block and are separated from the latter by the components of the transmitter part.

4. An apparatus according to any of Claims 1 to 3, in which the receiver part is of the frequency changer type, of which only the high frequency amplifier and frequency changer stages are provided with inductive components, which are so disposed that their plane of radiation is orthogonal to the plane of radiation of the common ferrite member.

5. An apparatus according to any of Claims 1 to 4, in which the second winding is normally connected in series with the input circuit of the receiver part by means of a contact of a change-over switch, the other contact of which is connected to earth.

6. An apparatus according to Claim 5, in which the said switch is mechanically coupled to a second change-over switch, of which one contact is connected to the input of the receiver part, while its other contact is connected to the input of the transmitter part.

7. An apparatus according to any of Claims 1 to 6, in which the transmitter part contains a low frequency input amplifier provided with a capacitor which may be connected to the amplifier to convert it into a call frequency oscillator.

8. A transmitter-receiver substantially as hereinbefore described with reference to and shown in the accompanying drawings.

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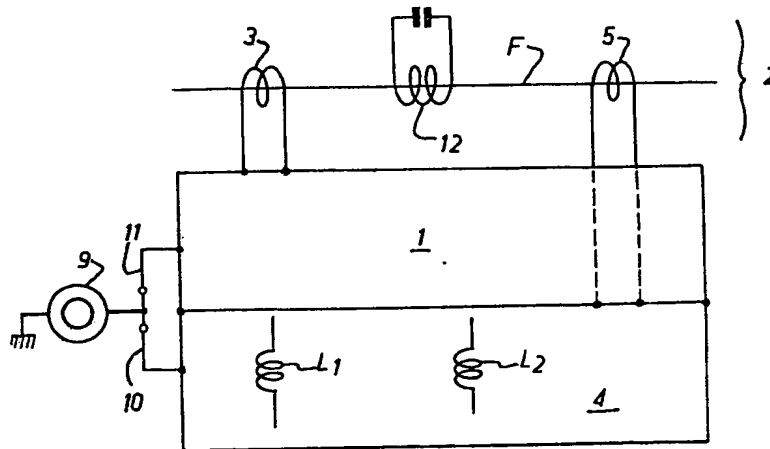


FIG.1

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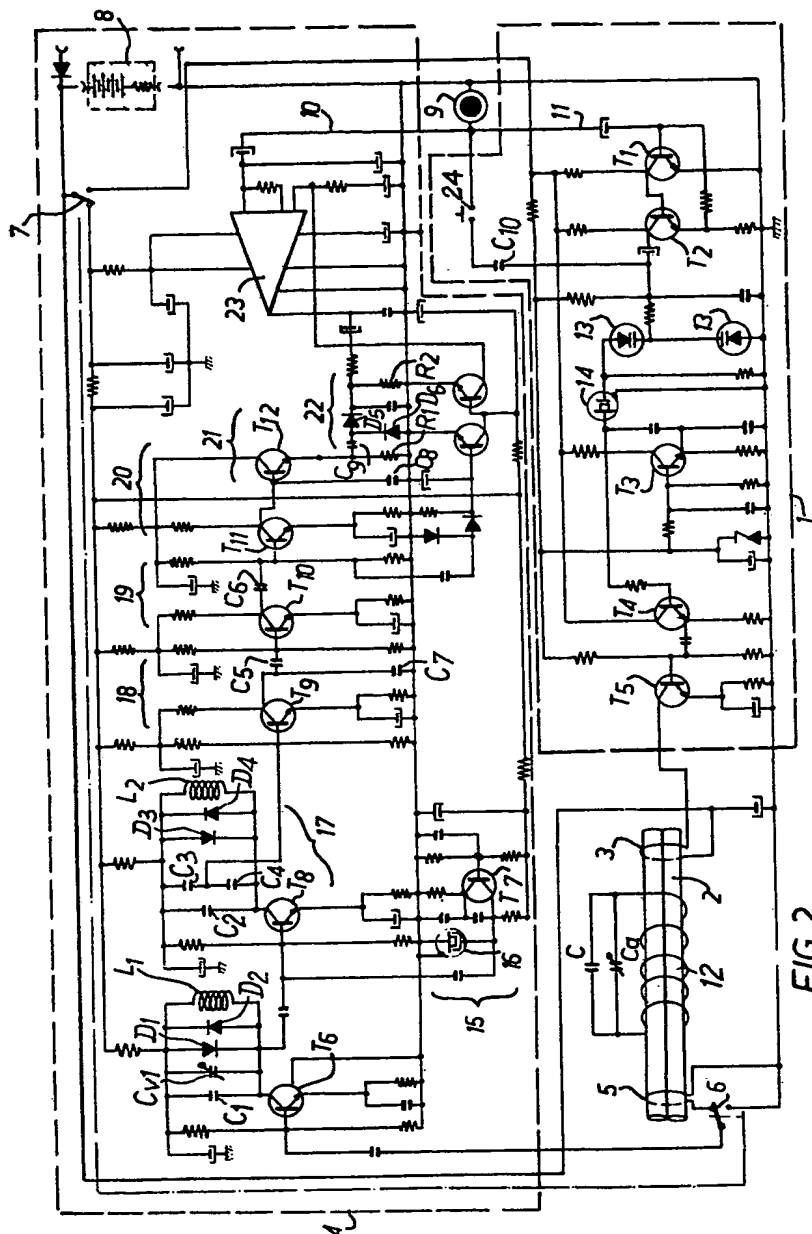


FIG. 2

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